

**Syntactic Priming of Noun Phrases in Children:  
Investigating Susceptibility to Preferred and  
Dispreferred Structures**

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# Contents Page

Tables and Figures.....	V
Abstract.....	vi
1 Introduction .....	1
1.1 Aim and Focus of the study .....	1
1.2 Research Questions.....	2
1.3 Layout of the Dissertation.....	2
2 Literature Review .....	3
2.1 Early syntactic priming studies .....	3
2.2 Syntactic priming from syntactic representations: .....	5
2.3 Studies with adult participants.....	7
2.3.1 Investigating verb phrases.....	7
2.3.2 Investigating noun phrases.....	8
2.3.3 Summary .....	9
2.4 Syntactic priming studies with child participants.....	9
2.4.1 Investigating verb phrases.....	9
2.4.2 Investigating noun phrases.....	12
2.4.3 Syntactic priming with Aphasic speakers .....	13
2.4.4 Summary .....	14
2.5 Abstract Syntactic Categories .....	15
2.6 Conclusion of Literature Review.....	18
2.6.1 Implications of the experiment.....	18
3 The Study.....	20
3.1 Methodology .....	20
3.2 Method .....	22
3.2.1 Design .....	22
3.2.2 Participants.....	22
3.2.3 Materials.....	22
3.2.4 Procedure .....	24
3.2.5 Predictions.....	25
3.3 Results .....	25
3.3.1 Children's Results.....	25
3.3.2 Other Results.....	26
3.3.3 Adult's Results.....	27
3.3.4 Questionnaire Responses .....	28

3.4	Analysis .....	29
4	Discussion .....	32
4.1	Children's Results .....	32
4.1.1	Preferred and Dispreferred Structures .....	33
4.1.2	Children's Susceptibility to Priming .....	33
4.1.3	'Other' Responses .....	33
4.2	Adults' Results.....	35
4.2.1	Preferred and Dispreferred Structures .....	35
4.2.2	Adults' and Children's Susceptibility to Priming.....	36
5	Conclusion .....	38
6	References .....	39
7	Appendices .....	42
7.1	Items.....	42
7.2	Questionnaire .....	44

# Tables and Figures

## Tables:

1. Priming Conditions .....	23
2. Children's Results .....	25
3. Proportion of 'Other' Responses in Each Priming Condition .....	26
4. Proportion of Bare Noun Responses and 'Other' Responses .....	27
5. Adults' Results .....	27
6. Mean Proportion of Noun-Relative Clause Responses by Children and Adults .....	29

## Figures:

1. Representation of Syntactic Information Associated with Nouns .....	5
2. Proportion of Children's Responses to Each Prime .....	26
3. Proportion of Adults' Responses to Each Prime .....	28
4. Mean Proportion of Children's and Adults' Noun-Relative Clause Responses to Each Prime .....	30

# Abstract

The present study investigates syntactic priming with children aged three and four. It examines whether children can be primed to use two alternative complex noun phrases (an adjective+noun structure and a noun+relative clause construction) to describe pictures, how susceptible children are to priming (in comparison to adult subjects) and which of the two alternative phrases is preferred according to a baseline condition (a bare noun prime). The priming task was a children's game, 'Snap', in which the picture cards were described. The participant heard the experimenter describe her card then described their own: the phrase they produced was thus primed from their comprehension. The main result was that children were primed to use both structures, although following the baseline condition the adjective+noun phrase was used at most, and at more than chance level, leading to the conclusion that this structure is the preferred. The results from the experiment with adults were only marginally significant in the items analysis only. Otherwise there were no significant effects with these participants; the experiment design was considered as a possible reason for this outcome. Since the adults were not reliably primed using this method, no firm conclusion as to the susceptibility of children to priming, compared to adults, could be made. There was however a strong priming effect among the child participants.

# 1 Introduction

## 1.1 Aim and Focus of the study

It is a noted phenomenon in first language acquisition that comprehension generally precedes production, (see, for example, Goldin-Meadow, Seligman & Gelman, 1976), meaning that a child is likely to be able to comprehend a structure before he actively produces it. It follows then that a child may not regularly or spontaneously produce a specific structure, due to, perhaps, limited processing capacities, but that the child has in fact already acquired the abstract syntactic representations required to comprehend it and perhaps also produce it. Therefore, building up a fuller picture of child language development, and finding out what syntactic structures a child has acquired at a given stage, would seem to require looking beyond his spontaneous productions and tapping into his linguistic knowledge.

One particular experimental paradigm that has been developed for doing this is syntactic priming: in brief, this involves inducing the production of a syntactic structure by a speaker through their immediately previous comprehension or production of that structure. Syntactic priming, or persistence as it is also referred to, is therefore the unconscious repetition of a particular syntactic structure across speakers and across subsequent, different utterances, even when an alternative structure is possible. An utterance's syntax is said to have an effect on subsequent expressions due to increased activation of the syntactic representations in use, that is, residual high activation of a structure enhances the likelihood of its selection for a subsequent utterance. If it is possible to prime a child to use a particular structure it is assumed that the child has acquired the abstract syntactic representations necessary to comprehend and produce that structure. Clearly it needs to be ensured that it is the syntactic information that is accessed and therefore priming the repeated use of a particular structure, and not the processes for comprehending or producing that structure, nor other factors such as context, repeated lexical items or simple copying, that are the source of the priming effect. This point will be examined in the literature review.

The present study aims to replicate and extend previous research on syntactic priming in child language production. It will investigate whether children of a certain age are susceptible to syntactic priming, in this particular case, of alternative noun phrases. Since priming effects are thought to be indicative of the abstract syntactic representations that a speaker has access to, finding such effects should be informative of the level of language development a child has reached with particular constructions. Such research is therefore interesting from both a language production and first language acquisition point of view. This study will also examine whether children can be primed to use a dispreferred alternative to a preferred

structure, compared to the use of such structures in their spontaneous speech and compared to the use of the preferred structures for expressing the same concept. Research suggests that children may be more susceptible to priming than adult speakers whose language systems are fully developed. If this was the case we would expect to see a priming effect of greater magnitude with child participants and perhaps also different effects for different syntactic structures. Therefore the study will also be repeated with adult participants in order to compare the priming of the same structures in children and adults.

## **1.2 Research Questions**

In this dissertation I will therefore examine the following questions:

1. Do children have abstract syntactic representations for complex noun phrases at the ages tested? I shall examine whether children can be primed to use noun phrases involving adjectives, nouns and relative clauses, which would suggest that they can access such syntactic items and constructions.
2. Can children be primed to use dispreferred constructions in comparison with preferred structures? That is, structures, such as a noun and a relative clause, which due to greater syntactic complexity and general rarity are less likely to be used than a simpler alternative such as an adjective and a noun.
3. Is the priming effect the same in adults and children or are children more susceptible to priming?

## **1.3 Layout of the Dissertation**

In the following chapter, the literature review, I will examine previous research into syntactic priming: how the experimental paradigm has developed and what has already been investigated using it, both with adult and child participants. I shall also briefly discuss the areas of language involved in this study, namely children's acquisition of abstract syntactic categories for noun phrases and their components. The third chapter details the experiments that were carried out for this piece of research: the method, results and statistical analyses. The fourth discusses the outcome of those experiments and in chapter five I conclude this dissertation.



## 2 Literature Review

In this section I will provide a background to the present study through an appraisal of the relevant literature. In this review I will examine how the syntactic priming paradigm developed. I will look at previous syntactic priming research with both adults and children as participants targeting both noun and verb phrase structures, the findings that this research has produced to date and the explanations proposed thereof. Given that most of the research into syntactic priming points to abstract syntactic representations as the locus of the priming effect, in the final section of this literature review I will discuss children's development of abstract syntactic representations with specific reference to nouns and complex noun phrases.

### 2.1 Early syntactic priming studies

Bock (1986) developed the syntactic priming experimental method based on observational evidence that people tend to repeat syntactic structures across utterances (see, for example, Levelt & Kelter, 1982; Weiner & Labov, 1983). In a controlled experiment, she found that when participants repeated a sentence they had heard (the prime) and then described a picture, the sentence they used to describe the picture often had the same syntactic structure as the first sentence they produced; by saying the first sentence the participants primed the structure of the second sentence. For example, in the transitive sentence condition the prime was either active or passive, so the participant would either repeat: "*one of the fans punched the referee*" or "*the referee was punched by one of the fans*". When the participants then described a picture, they tended to repeat the sentence type that they had just used: if their prime was active they were more likely to describe the picture using an active construction, "*the lightning struck the church spire*", whereas if their prime was passive they were more likely to use a passive construction, "*the church spire was struck by lightning*". Bock also tested and found this repetition effect for prepositional and double object dative sentences.

Furthermore, by controlling for other possible factors that could cause the priming effect, such as lexical similarity, or participant awareness (the priming study was embedded in a recognition memory task), Bock (1986:379) was able to conclude that the priming effect:

*"does not seem to depend on superficial relationships between successive sentences, but on more abstract structural similarities".*

This finding was supported by further research by Bock and her colleagues: Bock & Loebell (1990) found that structurally similar types of sentences had similar priming effects compared with structurally different sentences. For example, they found that passives were more likely to be primed by locative as well as passive primes (such as, "*The 747 was landing by the airport's control tower*" and "*The 747 was alerted by the airport's control tower*"

respectively) than by active primes (“*The 747 radioed the airport’s control tower*”) and they attained a similar effect for prepositional dative and locative primes priming prepositional dative structures compared to double object dative primes. A third experiment confirmed that the priming effects were not due to superficial sentence features such as sentence rhythm or closed-class words that are used in both types of phrase, such as ‘by’ (passive and locative) or ‘to’ (prepositional dative and locative). The priming effect of sentences that had superficially similar but structurally different forms (such as infinitives “*Susan brought a book to study*” and prepositional datives “*Susan brought a book to Stella*”) was compared. It was found that the dative sentences primed the production of the same dative structure in the target sentences, but that the infinitive structures did not prime the dative, leading Bock & Loebell to conclude that it was the structure of the sentences, not the surface features, that caused the priming. Similarly, Bock, Loebell & Morey (1992:162) found structural priming from passive and active primes regardless of manipulations of the animacy of the subject argument:

*“active primes with inanimate subject-arguments were as likely as active primes with animate subject-arguments to elicit active targets”.*

More specifically Bock & Loebell (1990) claimed that it was the procedures or operations for sentence formation that primed the repetition of a structure. The priming effect in these studies (Bock & Loebell, 1990 and Bock, Loebell & Morey, 1992) was obtained from production to production, as in Bock (1986): participants heard a description of a picture and repeated it (the prime) and then described a new picture. It was claimed that priming occurred *because* the participants produced the prime structure themselves before describing their own picture. Bock & Loebell (1990:32) state:

*“the mechanism of priming seems likely to be found in the retrieval and assembly of the [sentence] frame’s component structures”.*

Others have however contested this argument, claiming instead that the locus of priming is in fact at the level of syntactic representation, not at the level of processing the syntax.

Branigan, Pickering, Liversedge, Stewart & Urbach (1995) argue that the syntactic priming paradigm can be used to investigate the mental representation of linguistic knowledge since it is precisely this that is being tapped into or manipulated. They suggest that the linguistic processes involved in language comprehension and production both draw upon a common level of syntactic representations and so it is here and not at the level of processing that priming occurs. Therefore, they claim, it should be possible to prime the production of a structure from a person’s comprehension of that structure (without that person producing the prime themselves). This would provide evidence that priming takes place at the level of syntactic representation, since the procedures for the two processes involved, comprehension and production, are different and cannot be the cause of priming from one to the other.

Research has confirmed that priming does take place from comprehension to production and this will be discussed below. First I shall examine the theory behind how priming occurs from syntactic representations.

## 2.2 Syntactic priming from syntactic representations:

Understanding how syntactic priming may be informative of a speaker's syntactic representations requires examining how such information is stored and accessed within the language production or comprehension systems. Pickering & Branigan (1998) propose that the syntactic information of words (in particular, categorical, featural and combinatorial information) is represented at the lemma stratum of language production models (Roelofs 1992; Levelt, Roelofs & Meyer 1999); each lexical item is represented by a lemma node that is connected to nodes representing each aspect of its syntactic information. Pickering & Branigan (1998) gives details of how verbs are represented in this model, while Cleland & Pickering (2003) outline how nouns and their syntactic properties are represented, (see Figure 1 below).

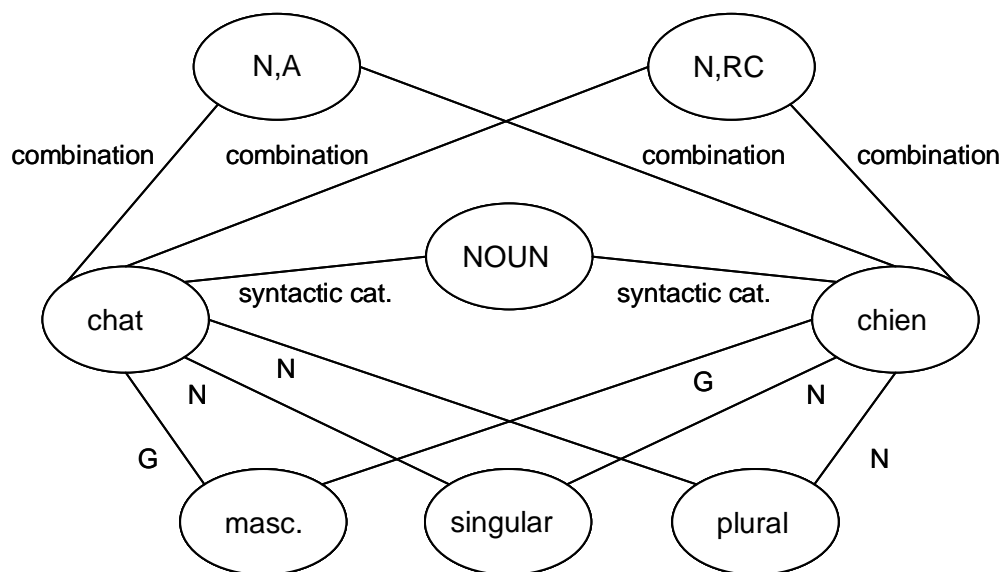


Figure 1: Representation of syntactic information associated with nouns (types of nodes and links are labelled: N = number, G = gender, masc. = masculine N,A = noun+adjective, N,RC = noun+relative clause). Adapted from Pickering & Branigan (1998:635, fig.1) and Cleland & Pickering (2003:215, fig. 1).

As the above diagram shows, each item's lemma node is attached to nodes representing the category information (noun), the featural information (singular, plural, and in other languages, gender, case and so forth) and combinatorial information (how the item combines with other items to form expressions: noun + adjective or noun + relative clause being two examples). Those nodes representing syntactic properties are attached to all items that they represent.

Pickering & Branigan (1998) explain that priming takes place within such a system due to residual activation of particular nodes and the links between them: if a lemma and combinatorial node become activated they, and the link between them, may retain activation that boosts the likelihood of the same syntactic structure being selected in a subsequent utterance. Pickering & Branigan found that the likelihood of syntactic persistence was enhanced if the same lemma was used, which was predicted given that in this situation the lemma node, the combinatorial node and, importantly, the link between them are all activated. If a different lemma was required the likelihood of priming decreased slightly since only the combinatorial node's activation remains relevant and the link to the new lemma is not activated. To illustrate: it is assumed that if a person hears a phrase such as "*un chat jaune*" (a yellow cat), then the lemma node for 'chat' and the combinatorial node (N,A) will become activated<sup>1</sup>. If they then need to describe a green cat they could use either structure represented by the combinatorial nodes (N,A), "*un chat vert*", and (N,RC), "*un chat qui est vert*", but they are more likely to say "*un chat vert*" since the nodes for the structure and noun required have already been activated. If they have to describe a green *dog*, they are still more likely to say "*un chien vert*", than for example, "*un chien qui est vert*", as the combinatorial node for the former phrase (which will be linked to the lemma node for dog) is activated, even though the lemma node itself is not.

Under this model, syntactic priming is therefore considered a useful experimental paradigm for tapping into a subject's linguistic knowledge and can be used to find out how that knowledge is arranged and processed. For example, Pickering & Branigan (1998) also found from a written, sentence completion task that priming of a structure such as a prepositional or double object dative occurred even when the verb form was varied for tense, aspect and number, (for example priming still occurred if the prime contained a verb in the past tense, but the target form required the present tense). Nor did changing the above features of the verb affect the magnitude of priming (unlike changing the lexical item), leading them to conclude that the nodes containing the combinatorial information of lemmas are connected directly to the lemma nodes which are unspecified for such syntactic features as tense and aspect, this information being contained in distinct nodes (see Figure 1 above) and therefore having no influence on the structure selection. This model of syntactic representation is supported by a number of studies on syntactic priming which will be discussed below.

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<sup>1</sup> The representation of adjectives and their syntactic features are not represented in the above diagram however it is assumed that they are modelled as a lemma node, plus its syntactic nodes, also attached to the combinatorial nodes.

## 2.3 Studies with adult participants

### 2.3.1 Investigating verb phrases

As noted above, the theory that priming occurs when structures are activated at the level of representation (and not in the processing of them) is best supported by showing that priming occurs between two different processes, comprehension and production: it is presumed that it is the shared syntactic knowledge that the two processes use that causes priming, since the procedures involved for each are different. One study that demonstrated this was Branigan, Pickering & Cleland (2000) in which priming was induced through dialogue: participants were primed by a sentence that they heard (that is through their comprehension of that sentence) to use a particular structure in sentences that they subsequently produced.

Branigan, Pickering & Cleland (2000) introduced the scripted confederate technique in order to do this: the experiment involved pairs of participants taking turns to describe pictures for each other to find from a selection in front of them. Whilst one of the participants was genuine, the other was a confederate of the experimenter who had a script of the descriptions to use for each picture: unbeknownst to the genuine participant each description given by the confederate was a prime for their own subsequent descriptions. This way the type of sentence that the naïve participant heard was controlled. All the experimental items involved dative sentences; the priming sentences that the confederate read out were either prepositional or double object datives, for example, “*the cowboy offered the banana to the burglar*” (prepositional) or “*the cowboy offered the burglar the banana*” (double object). The researchers varied whether the confederate and the participants’ descriptions also required the same verb or a different verb. Branigan et al. found that participants showed a strong tendency to use the same structure that they had just heard to describe their own picture, rather than the alternative, equally possible structure. This tendency increased when the same verb was used in the prime and the target utterances.

These results support the theory that comprehension and production draw on shared underlying syntactic representations and that it is residual activation of these that causes priming. Similarly to Figure 1, the syntactic information of verbs is encoded at the lemma stratum: each sentence type is encoded by a combinatorial node connected to the verb lemma node. For a verb like ‘*offer*’, the lemma will be connected to a combinatorial node representing the prepositional dative construction and another representing the double object dative construction. Whichever sentence type the participant hears will activate the corresponding nodes at the lemma stratum. When the participant has to produce a sentence involving similar concepts, the residual activation of these nodes (both the lemma and the combinatorial nodes) means that the syntactic information represented by them is more likely

to be selected for production, hence the observed repetition effect across utterances. The increased priming effect found when the same verb was used in both prime and target sentences is attributed to residual activation of the combinatorial node and the verb lemma node *and* the link between them.

### 2.3.2 Investigating noun phrases

Whilst earlier research concentrated on syntactic priming of verb phrases, Cleland & Pickering (2003) used the same methodology (scripted confederate and picture description task) as Branigan et al. (2000) to examine priming of complex noun phrases. Participants had to describe pictures of coloured objects; the two alternative primes were an adjective-noun construction such as “*the red sheep*” and a noun-relative clause construction, for example, “*the sheep that’s red*”, (see Figure 1 for the representation of these phrase structures at the lemma stratum). In one experiment the participants described coloured shapes: the researchers found that overall the participants were 19% more likely to use the same construction that they heard in the prime sentence: they were 12% more likely to repeat the syntactic structure when the shapes differed from prime to target description and the priming effect rose to 27% when each description used the same shape, that is the same lexical item. In a second experiment they described pictures of everyday objects. The researchers varied whether the prime and target descriptions required the same noun, a semantically-related noun or an entirely unrelated noun. They obtained an overall priming effect of 29% which increased to 31% priming when the two nouns were semantically-related, 41% when they were the same and decreased to 8% when they were different.

Overall the results showed that subjects were more likely to repeat the syntactic structure that they had just heard, rather than use an alternative, and this effect was enhanced when the lexical items were repeated or related. Interestingly Cleland & Pickering also reported a distinct preference for the adjective-noun phrase over the noun-relative clause phrase: when it was not primed, the relative clause construction was rarely used by the participants (whereas an adjective-noun phrase might very likely be used following a noun-relative clause prime). They suggested that this dispreference may be due to the relative clause being rare in this context and structurally longer and more complex than the alternative construction. Despite this, it was possible to prime the use of a relative clause construction in the target response, especially when the noun and adjective were repeated, leading Cleland & Pickering (2003:226) to state:

*“the fact that these preferences for the pre-nominal construction could be greatly reduced therefore demonstrates the strength of the priming effect resulting from our paradigm”.*

This research shows that for adult speakers the noun-relative clause combination is a dispreferred structure in this context, but that it is still possible to prime adults to produce it.

### 2.3.3 *Summary*

This section has explored how the syntactic priming method has been developed through research with adult speakers. It has also reviewed priming experiments with verb phrases and noun phrases which have found that adults can be primed to use a variety of structures, including those that are normally dispreferred. More recently this experimental method has been used with subjects other than adults with normal language capacities, such as aphasic patients (Hartsuiker & Kolk (1998)) and children (Savage, Lieven, Theakston & Tomasello 2003; Huttenlocher, Vasilyeva & Shimpi 2004; Branigan, McLean & Jones (2005)). In the following section I turn to syntactic priming research with child participants. Although there have so far been very few studies carried out, research with children has also found structural priming effects for verb and noun phrases in picture description tasks. In terms of investigating children's linguistic development, this paradigm may be highly useful for examining the syntactic representations they have at a particular stage in their acquisition of a native language: priming occurs when the combinatorial nodes associated with syntactic properties are residually activated, therefore if a child has acquired or developed the appropriate representations for a given syntactic structure it is assumed that it will be possible to prime him to use it, even if he does not use it regularly or spontaneously in normal speech.

## 2.4 **Syntactic priming studies with child participants**

### 2.4.1 *Investigating verb phrases*

Savage, Lieven, Theakston & Tomasello (2003) tested three, four and six year old children's production of active and passive sentences with a view to assessing the abstractness of their syntactic representations. In their study the experimenter and the children described cartoons of transitive actions taking place: in their first experiment the children heard and repeated the experimenter's description (the prime) before describing their own picture, whereas in the second they only heard the prime and then described their own picture. This distinction across the two experiments was designed to test whether the children were primed by the process of producing the transitive sentence or by the underlying syntactic representations for transitive structures accessed in both the comprehension and production of such sentences. Savage et al. also tested priming when there was a high lexical overlap in the prime sentence (the subject and object of the sentence were described using the same pronoun, for example "*it is pushing it*") and when there was a low lexical overlap in the prime sentence (the subject and object of the sentence were described using full noun phrases (and different lexical items) such as "*the arrow shot the tree*"). The subjects received each type of prime, active and

passive, in separate blocks on separate days, that is, on one day the children would be primed only by active sentences, on another day, at least a week later, they heard only passive sentences.

Savage et al. reported a structural priming effect for the *noun phrase* of the prime sentences, that is, for the alternation between nouns and pronouns. The children were more likely to use a full noun phrase rather than just a pronoun after hearing a prime containing full noun phrases (the low lexical overlap condition) and they were more likely to use pronouns in the high lexical overlap condition, when the priming phrase contained only pronouns. They concluded therefore that there was syntactic priming for the general category Noun. Their results for the verb phrase priming were, however, less consistent. They did find priming in both types of experiment, with and without repetition of the prime by the children, suggesting that (2003:564):

*“the priming observed in the first study does indeed involve children’s linguistic representations, not simply peripheral production mechanisms”.*

This supports the evidence from experiments with adult participants and strengthens the theory that syntactic priming is not related to the processing involved in sentence production but to the underlying syntactic representations of the sentences that are produced.

However, they reported that only the oldest children were *structurally* primed to produce active and passive sentences since only they were primed in the low lexical overlap condition, as well as the high overlap condition. The three and four year old children only showed priming effects for either active or passive phrases in the high lexical overlap condition. They concluded therefore that while six year olds may have developed adult-like abstract syntactic representations for transitive sentences, three and four year olds have not and their syntactic constructions are instead based on lexical items since priming only occurred when lexical items were repeated. What is unclear however is exactly how a high lexical overlap for the noun phrases, that is when the nouns were both replaced by the pronoun ‘it’ in the priming sentence, would induce priming of either an active or passive form in the verb phrase. One would expect priming of an active or passive structure to be more likely if the same *verb* was required in both the prime and target sentence and this would suggest a lexical effect on priming, (although it would not necessarily mean that children’s representations were item-based). However, repeated lexical items in the noun phrase should not be relevant to priming of a verb phrase structure. The fact that the researchers did find a distinction for high and low overlap sentences may be due to the fact that reducing the noun phrase to a simple pronoun eased the processing and therefore production of a passive sentence for the younger children; clearly this area requires further investigation.



Huttenlocher, Vasilyeva & Shimpi (2004) also investigated syntactic priming of transitive as well as dative structures in four and five year olds through a series of experiments. They too began by using the same methodology as Bock (1986): children were asked to repeat the experimenter's descriptions of pictures (this repetition of a phrase constituted the prime) then the children described their own picture (the target). In a second experiment the prime came from the experimenter's description alone (as in Branigan, Pickering & Cleland, 2000): the children heard a priming phrase from the experimenter and then described their own picture. Across these two experiments the researchers found very similar effects of priming for both transitive and dative sentences. The magnitude of priming did not differ significantly between the trials involving priming with repetition and those without; that priming occurred from comprehension to production (their second experiment) and not just from production to production (their first experiment) led them to further conclude (2004:192) that, in support of previous studies:

*“a common representational system underlies both the production and comprehension of syntactic forms”.*

In these experiments the lexical items were always different in the prime and target sentences: the objects and actions required for the target sentence were different to those used in the prime. That a priming effect was consistently found from prime sentence to target sentence allowed Huttenlocher et al. to conclude that the children were primed by the syntactic structure, rather than the lexical items themselves, as they state (2004:192):

*“the finding that children showed priming effects across the range of lexical items indicates that they have generalized syntactic forms for expressing transitive and dative relations”.*

This suggests, contra Savage et al. (2003), that children younger than six years old do represent the tested structures at an abstract level and not by lexical item. If the children's representations were item-based then one would not expect to have seen any priming in this experiment since, as stated above, the lexical items required for the target were always different to the prime.

Finally it is interesting to note that Huttenlocher et al. measured the children's spontaneous use of the primed structures prior to the experiments. They found that the use of passive sentences and both types of dative sentences was highly infrequent and constricted in the children's spontaneous language, yet these forms were produced during the course of the priming experiment. As with Cleland & Pickering's (2003) findings with regards the status of the noun-relative clause phrase, these results suggest that these verbal structures may be in some way dispreferred by children of four to five years of age when producing sentences that

express their semantic content. This suggests that syntactic priming is indeed an effective way of tapping to a child's abstract syntactic knowledge, (rather than relying just on children's utterances to assess their stage of language development), as Huttenlocher et al. also concluded (2004:192):

*“children may demonstrate the use of an abstract form in a priming study even when that form is not fully available for on-line use”.*

These results seem to suggest that children may be particularly facilitated by priming: residual activation of their syntactic representations through comprehending a priming sentence facilitates their accessing this information when they need to produce a sentence expressing the same concept and it therefore facilitates their production of rarely used structures.

#### 2.4.2 Investigating noun phrases

Branigan, McLean & Jones (2005) extended Cleland & Pickering's (2003) investigation of priming noun phrases using instead young children as participants. They examined whether children aged three and four showed evidence for adult-like, abstract syntactic representations for nouns and adjectives, that is, whether they could be primed to use the same structures as primed in adults thereby suggesting that they had developed the appropriate categorical and combinatorial information for the items in question. They adapted the confederate priming technique to make the experiment task more child-friendly: instead of participants describing pictures for each other to find, the picture cards were used as 'Snap' cards. The participants took turns to turn over a card and describe it, they then decided if it was a match (a 'Snap') or not; the experimental items were never a 'Snap' however a few filler items were created that did match to preserve the authenticity of the 'game'. They found that children responded well to this task as it was easy to understand and to take part in. As in the experiments by Cleland & Pickering (2003), one of the players was a confederate of the experimenter and gave descriptions from a script of priming sentences. The two alternative primes were an adjective-noun construction and a noun-relative clause construction; in some trials the noun was repeated between prime and target, in others it was different.

Branigan et al. found a very strong priming effect: the children used the same structure as the prime in 80% of their target descriptions. When the noun was repeated they used the same syntactic structure in 70% more descriptions than used a different structure, this effect was reduced to 52% when the prime and target contained different nouns. They concluded that young children do have abstract syntactic categories of noun and adjectives as well as the combinatorial information of these items. Whilst there was a stronger effect when the lexical item was repeated, the children were also primed to repeat the syntactic structure when the lexical items differed suggesting that the effect was not entirely item-based: the children were

accessing abstract syntactic representations rather than information stored in some way with the lexical item itself. These results also contradict Savage et al.'s (2003) overall conclusion that children younger than six years old do not have abstract syntactic representations, although both groups' research did in fact find structural priming for noun phrases suggesting that by the age of three or four children have indeed developed an abstract representation for the category Noun. Branigan et al. noted that in their experiment priming occurred for both the preferred and dispreferred structures, as identified in Cleland & Pickering (2003).

Finally, the researchers also pointed out that as far as the results can be compared to the findings with adult participants, the priming effect in children was particularly strong. They suggested that this may be due to weaker or less easily accessed syntactic representations. The prime sentence facilitates access to the syntactic representations by activating them during comprehension, prior to production; if children have weaker representations they will be more receptive to this facilitation. Savage et al. (2003:560, footnote 1) also reported a particularly strong priming effect in their experiments with children, although Huttenlocher et al. (2004) did not comment on the magnitude of priming in children compared to adults since, as all noted, differences in the methods of the experiments mean that no direct comparison can be made with the results from studies with adults. Therefore it cannot be confirmed that this strong effect found in children is due to their increased susceptibility and not the experimental methods. However, research to date seems to imply that people whose language system may in some sense be 'less complete' may be more susceptible to and facilitated by priming: Branigan et al. (2005) also refer to research by Flett, Branigan, Pickering & Sorace (2004) which showed that second language learners are highly susceptible to priming and Hartsuiker & Kolk (1998) reported a similar, strong priming effect in their study with Broca's patients, people whose ability to produce syntactically complex structures is limited as a result of, it is hypothesized, reduced processing capacities.

#### *2.4.3 Syntactic priming with Aphasic speakers*

Hartsuiker & Kolk (1998) compared syntactic priming in aphasics and 'normal' speaker controls and found that the aphasic participants showed stronger priming effects than the controls and were primed to use syntactic structures they rarely produced in spontaneous speech. They conducted a series of priming experiments with transitive and dative sentences in Dutch: the first replicated the methodology of Bock et al. (1992) by embedding the priming experiment within a picture recognition task, the second experiment consisted of priming through picture description, without the mask of the recognition task and in the third the participants were told explicitly to reuse the syntactic form of the sentence they had just heard to describe their own pictures. With this last study, the experimenters tested whether the

participants were capable of employing such a strategy and thereby controlled for its possible use in the previous experiments. The results from the control group of normal speakers showed no effect of prime on the passive and dative sentences in the first two experiments<sup>2</sup>, but a strong correlation between response and prime type in the third suggesting they were able to employ the strategy of explicitly reusing a syntactic structure. In the aphasics' results they found priming for passive and dative sentences in all three experiments but no significant effect of experiment type on the magnitude of priming: unlike the normal controls, the Broca's patients were seemingly unable to employ the strategy of explicitly copying the syntactic structure of a prime sentence leading the researchers (1998:242) to conclude that:

*“the priming effects we observe must be the result of an unconscious, automatic, facilitatory process rather than of a strategy”.*

Hartsuiker & Kolk compared the priming results to spontaneous speech data and results from baseline sentences (a locative sentence in the transitive prime condition and a transitive sentence in the dative prime condition). They found that neither group spontaneously produced datives, but both used them frequently following the baseline prime and the experimental primes. The normal controls used passives in spontaneous speech, however the aphasics used them rarely, if at all; the condition in which the Broca's patients most frequently produced passives was the passive prime condition. They suggest therefore that, as found with the child participants, priming facilitates the use of structures that are normally beyond the processing capabilities of aphasic speakers, which implies that syntactic priming taps into abstract syntactic knowledge which may exist beyond production capabilities.

#### 2.4.4 Summary

The methodologies used in the priming experiments discussed so far vary considerably and as such it is not possible to directly compare the results and make inferences from them as a whole. However there is a general pattern emerging in this field of research of moderate priming effects with adult participants and stronger priming effects among language learners and impaired language users, that is, those people who might be most facilitated by priming. It is also clear that it is possible to induce the production of dispreferred or rarely used syntactic structures in speakers of all levels, which supports the theory that these utterances are primed and not spontaneously selected structures. Much of the research appeals to the explanation that the locus of the priming effect is indeed at the level of syntactic representation rather than that of lexical items or indeed at the level of language processing or production itself. In the following section of this literature review I shall briefly examine this

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<sup>2</sup> Previous research by Hartsuiker & Huiskamp (1996) also showed no priming effect in Dutch speakers for active and passive transitives.

aspect: the development of abstract syntactic categories, with particular reference to the areas of language with which this study is concerned.

## 2.5 Abstract Syntactic Categories

According to the research reviewed above, syntactic priming provides a way of tapping into a speaker's abstract syntactic knowledge, beyond even that language which they actively produce. These findings and future research within this experimental paradigm have therefore important implications for theories of how language is stored in the brain and accessed for production, and also for theories of children's development of abstract syntactic representations.

Different groups have different theories on how and when children develop abstract syntactic categories. For example Tomasello (2000) outlines a constructivist theory of child language acquisition whereby syntactic categories are gradually constructed through lexical-based learning. He refutes the nativist theory that children are born with linguistic or syntactic knowledge to which they must match up their ambient language. He claims that children develop structures for individual items based on their linguistic experience, independently of other items of the same category in adult grammars and in the absence of syntactic categories or schemas on which to base them. For example, he claims that rather than having a framework for transitive verbs which allows children to know that a verb such as 'kiss' must have a subject and an object, children learn that the action 'kiss' has a 'kisser' and a 'kissee'. New verbs are learnt independently in a similar fashion until, around the age of three, the child has assimilated this knowledge into abstract syntax. He interprets evidence from diary data and data from experiments with nonce words as showing that children are not as productive with new lexical items as the generative account would expect. He claims that if children were endowed with abstract syntax they would be able to use novel lexical items in structures they had not heard them used before.

On the other hand, language acquisition researchers working in the generativist paradigm, such as Fisher (2002) have challenged Tomasello's claims and interpretations of the data, claiming that this apparent lack of productivity may be due to lexical *effects*, which do not rule out the possibility of children having abstract syntactic representations. For example Fisher states that children may be reluctant to use new verbs in unattested structures, such as a transitive, since it is unlikely that they will assume that a new item can be used in any given structure, given that languages place item-specific restrictions on the argument structure of verbs. Furthermore, she points out that adults have been shown to use lexical information during language processing and therefore it is likely that children also assimilate information

about specific lexical items for such use, however this does not imply that children have purely item-based representations and do not have abstract syntactic knowledge guiding their early language development. The syntactic priming research with children discussed previously would seem to support this latter position.

Nevertheless, it seems that regardless of initial state, these theories agree that by the age of *three* children will have developed the syntactic representations in question, (note that the syntactic priming experiments that have been carried out so far tested children aged from three upwards, therefore one would expect these experiments to show priming as one would expect the children to have already acquired the abstract syntax). The present study is concerned with noun phrases, the abstract representations of which have been shown to be acquired by children of three and four (Branigan et al. 2005). Indeed Tomasello (2000:211) begins his discussion of children's acquisition of verbal structures with the proviso that:

*“they can substitute nominals for one another relatively freely”.*

This suggests that far from having no grammatical schemas or categories, as he claims, children have from a very early age at least some kind of category for nouns, and the research reviewed above appears to support this.

Indeed, other research has shown that children do appear to acquire syntactic categories for nouns and noun phrases at a very young age, certainly before the age of the children tested in the present study (aged three and upwards). Valian (1986) investigated two-year olds' knowledge of syntactic categories, specifically those of determiners, adjectives, nouns, noun phrases, prepositions and preposition phrases. She analyzed corpora of the children's usage of these items for evidence that children met certain linguistic criteria suggesting they had acquired the above categories. These criteria included correct positioning of each item with respect to other items (for example that determiners always preceded adjectives and nouns), correct sequencing of items (such as allowing two consecutive adjectives, but not two determiners), the correct combinations of items (for example determiners and nouns but not determiners and pronouns) and substitution (for example of a whole noun phrase with a pronoun). From her study of six young children's spontaneous speech she concluded (1986:572) that:

*“by age 2 years, 6 months ... children have knowledge of many of the lexical and phrasal grammatical categories used in the adult grammar”.*

This corpora evidence is supported by experimental data from Tomasello & Olguin (1993). They tested the ability of children aged between 20 and 26 months to use plural morphology with novel nouns, and to place these experiment nouns in sentence structures. Data was

collected from play sessions and a Wug test<sup>3</sup>. Even though the children had never heard these novel nouns used in the plural, five out of eight children productively used the plural affix *-s* when shown two items representing the new word. Furthermore whilst the experimenters controlled for the types of roles each child heard the novel nouns used in (for example some heard it used either as only an agent or patient of transitive sentences, some heard it in both roles, others in none at all), all children produced the experimental nouns in both roles of transitive sentences as well as in many other types of utterances. These results show that children of two years of age are able to be productive with novel nouns suggesting they do have an abstract category for nouns, as Tomasello & Olguin (1993:460) state:

*“the most reasonable explanation of the current findings is that during the course of this study children assimilated one or more of the newly-learned words to a grammatical category of noun”.*

Taken together this research suggests that children younger than three years old have the grammatical category Noun, and Valian (1986) also gives evidence for further categories including combinatorial knowledge such as noun phrases.

The present study tests one further complex noun phrase structure not covered by the above, namely the noun-relative clause structure. There is evidence, both corpora and experimental, which suggests that by the age of three children have also acquired relative clause structures. Diessel & Tomasello (2000) analyzed observational data from the CHILDES database. Their examination of longitudinal spontaneous speech data from four children aged between 1;9 and 5;2 revealed that while children’s use of relative clauses changed as their language developed, they did use relative clauses early on, but this was restricted to simple constructions expressing a single proposition; this expanded to relative clauses expressing two propositions as children got older. This is supported by research by Limber (1973). He collected spontaneous speech data and elicited production data, (mostly naming of objects and picture description) in separate laboratory sessions in order to study the development path of complex sentences. Whilst he found that before three years old children rarely produce relative clauses on common nouns, he states (1973:182) that:

*“by 3 these children have unmistakably acquired the ability to generate syntactically complex names and descriptions – complements and relatives”.*

This is precisely the task required in the present study. Therefore it is expected that in the current experiment the children will be at a stage in their linguistic development where they have abstract syntactic representations for the items being tested and so it will be possible to prime them to produce the phrases required for the experiment; previous research (Branigan

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<sup>3</sup> As developed in Berko (1958).

et al, 2005) confirms that this is so. What this study is also concerned with though is the interesting effects that have come out of previous research with children (particularly strong priming and distinct preferences for or effects of particular structures) mentioned above.

## **2.6 Conclusion of Literature Review**

In this chapter I have discussed adult syntactic priming and more recent work in this paradigm with children. The research reviewed has shown that syntactic priming can be induced from either a participant's production or comprehension of a target structure. That this effect is found across language parsing and production mechanisms has led to the suggestion that it is at a level of syntactic representation, accessed by both procedures, that priming occurs. Syntactic priming research has also shown that participants can be primed to produce less-preferred structures or even those rarely used in spontaneous production. Preliminary research with participants other than 'normal' adult speakers suggests that certain 'vulnerable' language users are seemingly particularly susceptible to syntactic priming.

The present study focuses on these two aspects with reference to the production of complex noun phrases: whether children are indeed particularly susceptible to priming and whether children show a distinct preference or dispreference for either of the alternative structures. This study builds on the work by Cleland & Pickering (2003), on priming of such structures in adult subjects, and the study by Branigan et al. (2005) which extended the investigation of priming noun phrases to younger subjects. Branigan et al.'s (2005) results suggest that children aged between three and five years old do have adult-like representations for complex noun phrases; where they appear to differ from adults is in the extent to which they can be primed. Therefore in this study data is collected from adult participants using the same task in order to be able to directly compare the priming effects for both groups and examine whether children are particularly sensitive to priming. This study also uses a baseline condition to examine the priming of the preferred (adjective-noun) and dispreferred (noun-relative clause) structures as identified by Cleland & Pickering (2003).

### **2.6.1 Implications of the experiment**

According to the theory of syntactic priming based on the model of syntactic representation represented in Figure 1, finding a priming effect for the phrases used in the experiment would confirm previous research suggesting that children of the ages tested have acquired abstract syntactic representations for the phrase structures involved; the categorical nodes for nouns and adjectives and the combinatorial possibilities for these syntactic items: adjective-noun and noun-relative clause.



If the magnitude of the priming effect is indeed found to be greater overall in children compared to adults, it could be assumed that they are for some reason more susceptible to priming, although the possibility that the enhanced susceptibility is in fact due to the method of the experiment should also be considered. It is also possible that the different phrase types tested will show differing degrees of priming, which may be revealing as to why children are generally more susceptible to priming: if a phrase is not commonly used when not primed because it is structurally more complex, but does show susceptibility to priming over and above a preferred alternative, this could suggest that priming promotes the use of awkward structures by activating these representations, and generally facilitates language production. In the case of adult participants, this may be seen with the noun-relative clause condition (as found by Cleland & Pickering, 2003), this may also be the case with child participants, or it may be seen with both types of complex noun phrases if the children's syntactic representations are generally weaker than adults or more difficult to access. Other possibilities that could explain a repetition effect, such as that the children, or even adults, are consciously copying what they hear, should also be considered.

### 3 The Study

This study was a replication and extension of that by Branigan et al. (2005). The method involved a picture description task and a scripted confederate (the experimenter) and primed the participants' production through their comprehension of the immediately preceding description. As in Branigan et al. (2005) the priming test was embedded within the children's game 'Snap'. A number of differences were made to the design to test different aspects of priming with children which will be discussed, along with some general points about the design of the experiment, in the following section. I shall then outline the plan of the study and present the results from the experiments.

#### 3.1 Methodology

In order to maximise co-operation from the children, and to increase their chance of understanding and performing the picture description task, it was embedded in a game of Snap. Snap is a well known children's game in Britain in which two players each have a set of picture cards placed face down in front of them. They take it in turns to turn over the cards. When the two players turn over cards with the same picture on (creating a matching pair) the players shout 'Snap'. The first to shout wins both piles of the cards and the game continues until one player has won all the cards. In this experiment the game was played accordingly with the additional condition that the participant and the experimenter described the picture on each of their cards as they turned it over (the experimenter's description constituting the prime to the participants' subsequent description of their own card). The children were allowed to 'win' the Snap and take the cards, which were kept separately or underneath their remaining experimental cards.

In the present study and that by Branigan et al. (2005) all the different primes occurred randomly throughout the same experimental session, therefore priming was measured on a trial by trial basis. This design differs from previous syntactic priming experiments with children in which participants received separate blocks of each type of prime. It seems possible that this could have lead to a cumulative priming effect across the blocks; this design tests whether children are primed following one production of a particular structure and should thereby give an indication of the strength of priming or susceptibility of children to it. If priming were only to occur in the latter half of the experiment it could be assumed that children require a build-up of primes before they produce the structure, however if priming occurs during all stages of the experiment it will show that children are susceptible to just one occurrence of the structure. This design does not rule out any cumulative effect over the course of the experiment but it reduces the likelihood that the priming effect is particularly

strong with children purely because they repeatedly hear only one type of structure, as in previous experiments.

Unlike other experiments, this study did not include pairs of pictures which required repeated lexical items: the nouns and colour adjectives in the prime phrases were always different to those needed to describe the target. This removed the possibility that any priming effect was enhanced or even caused by lexical relatedness or item-based representations. This is important given that the present study aimed to investigate children's susceptibility to priming: previous experiments have shown that repeated lexical items increases the likelihood of priming occurring, this experiment will show whether children still exhibit particularly strong priming effects once that factor is removed.

Another aspect of this study was whether children would demonstrate the same preferences for the tested structures as found with adults (Cleland & Pickering 2003). Branigan et al. (2005) noted that priming occurred for both preferred and dispreferred structures but they did not discuss any differences in the use of either structure or the magnitude of priming for them. In the present study a baseline condition was introduced to investigate which structure was used spontaneously by children to describe a picture. In this condition the prime was a bare noun describing a black and white picture, the children's responses to their subsequent pictures (which were always coloured and therefore always required some combination of adjective and noun) should show which structure is indeed preferred when producing a simple description.

One area of possible concern was that the task would not work as desired with adult participants. Whilst it was necessary to use exactly the same experimental method with adults as used with the child participants in order to measure the magnitude of the effect in children, it was deemed possible that the experimental task would prove too obvious to the adult participants. Adults have been shown to be susceptible to priming of these types of noun phrases, but using a different method where the priming experiment was embedded in a communication task, (Cleland & Pickering, 2003). Since the task devised for child participants was a very simple and short game, it was a concern that the adults would be aware of the linguistic manipulations: they might notice that the phrases being used, in particular the noun-relative clause prime, were pragmatically marked in the context and might deduce that they were deliberately being used to create an effect; they might also notice that only the experimenter had black and white pictures to describe. Therefore it was suspected that they might consciously use certain structures, or at least be wondering why certain

structures were used by the experimenter which might result in skewed priming effects or no priming effect at all.

In order to try to control for this effect it was explained to the adult participants at the beginning that the experiment was being conducted to collect data to compare with child data and therefore the task was devised specifically for children to do and might seem a little simple to the adults. To check whether the adults were aware of the motivations behind the task they were asked to complete a questionnaire on it after the experiment was finished (see Appendix 7.2). This asked them what they thought the experiment was trying to do and if they were consciously using any particular phrases or were aware of what the other person was saying.

## **3.2 Method**

### *3.2.1 Design*

This experiment used a repeated measures design to test a group of pre-school children and a control group of adults. The independent variables were the three priming conditions. The dependent variable was the responses given by the participants to each prime. The order in which the different primes occurred was randomized to control for any effect of order.

### *3.2.2 Participants*

The group of child participants constituted 18 children, 9 girls and 9 boys, aged between 3;2 and 4;11 years old (mean age 4;0), recruited from the Uni-Tots Nursery in the Psychology department of Edinburgh University and from the University's day nursery. The control group constituted 15 adult, native speakers of English, 9 females and 6 males, (aged between 18 and 30, mean age 23.9), recruited from amongst the university population; where possible, participants were specifically recruited from outside of the Linguistics and Psychology departments in order to avoid using students who might be aware of the experimental paradigm in use.

### *3.2.3 Materials*

The experimental materials consisted of three sets of cards with pictures of everyday objects: a set of 24 target cards in colour, a set of 48 prime cards consisting of 24 pictures (different to those in the target set) in two formats, black and white and coloured, and a filler set of eight pairs of coloured 'Snap' pictures, that is 16 coloured cards that formed eight matching pairs. The 24 target pictures (those that the children described) were paired with the 24 priming pictures (described by the experimenter) to create the 24 experimental items (see Appendix

7.1). Each pair of cards that were turned over and described by first the experimenter then the participant represented one experimental trial.

There were three priming conditions: two conditions involving a coloured prime, the third a black and white prime (see Table 1). For the coloured pictures the two priming phrases were adjective+noun and noun+relative clause, the former being the preferred structure and the latter the dispreferred structure, (see above discussion of Cleland & Pickering 2003). The black and white pictures provided the baseline condition, described using a bare noun.

Condition	Prime Picture	Priming Phrase	Target Picture
1 - Adj+N	yellow hen	A yellow hen	blue bag
2 - N+RC	yellow hen	A hen that's yellow	blue bag
3 - Baseline	black and white hen	A hen	blue bag

Table 1: Priming conditions

Each participant saw the 24 target pictures once and therefore heard only one of the three possible priming phrase for each target picture, however, over the 24 target pictures the participant received an equal number of primes from each condition: eight target pictures primed by an adjective-noun phrase, eight by a noun-relative clause phrase and eight by the baseline phrase. There were three groups of cards created using Latin squaring such that all groups contained all target pictures with one prime and all target pictures were primed by all three prime conditions across the three groups. Eighteen randomized lists of the paired experimental cards plus the eight filler ‘Snap’ pairs, were created from the three groups of cards, (six lists from each group) according to which the cards were ordered in each players’ pack such that the participant turned over the correct target card following the experimenter’s prime card. In the experiment, these lists were also used as the script of priming phrases.

Finally, a separate set of ten practice cards (see Appendix 7.1) was also created using similar pictures as those that appeared on the experimental cards. The five cards in the participants’ practice set all had coloured pictures, in the experimenter’s practice set there were three coloured pictures and two black and white pictures: this reflected the type of cards each person described in the actual experiment. The practice set included black and white cards so that the participants knew that they would be described by simply a noun, for example, “*an aeroplane*”, (and not modified with the adjective ‘*white*’, as in “*a white aeroplane*”). All of the pairs of pictures were different objects except the final two which formed a snap. These cards were designed to introduce the participants to the format of the cards and game, to make

sure that the children understood what a ‘Snap’ was and that they understood and were able to perform the task.

### 3.2.4 Procedure

The experiment began with a practice session using the set of practice cards. The practice session was conducted exactly as the experimental session: the experimenter explained that they were going to play Snap and at the same time describe their cards. The experimenter began by turning over her first card and describing it, the participant was then encouraged to do the same with the first card on his pile. If the participant missed out either the colour or the object in their description they were asked what it was and then encouraged to give a full description of the card again.

In the experiment, the players alternated turning over a card and describing it before deciding whether it created a Snap or not. The experimenter began each experiment, and was always the first to turn over a card following a Snap. Her description (the prime) was given from the priming script, unknown to the other participant. The participant was then encouraged to turn over his top card and describe it (the target). If they omitted the colour from their description they were asked what the colour of the object was and then asked to give a full description of the picture. During the experiment with adults a box was placed between the experimenter and the participant onto which the cards were placed in order to hide the priming script from their view. Once the game was completed each adult was asked to complete the experiment questionnaire. Otherwise the procedures used in the experiment with adult participants were exactly the same as those used with the children. Each game was audio-recorded on a Mini-disc player.

Each game was transcribed and scored as follows: if the target description consisted of a noun preceded by an adjective (with or without a determiner), this was scored as an adjective-noun response (Adj-N), a response consisting of a noun followed by the adjective and including a complementizer (both ‘*that*’ and ‘*which*’ were produced by the participants) was scored as a noun-relative clause response (N-RC). Any other types of response were scored as Other. Trials where the child was unable to name the picture were discounted from the scoring as were those on which an error was made with the prime (for example if the experimenter said “*a green iron*” when the prime should have been a noun-relative clause, “*an iron that’s green*”).

### 3.2.5 Predictions

My predictions were:

1. By the age of three children have developed appropriate abstract syntactic representations for noun phrases, therefore,
2. both adults and children will show priming effects for priming conditions 1 and 2: they will be more likely to produce an adjective-noun phrase following an adjective-noun prime and a noun-relative clause phrase following a noun-relative clause prime.
3. As suggested by previous research, priming effects will be stronger, that is, of a greater magnitude, in children compared to adults, demonstrating that children are more susceptible to priming, rather than the method used to elicit priming.
4. Following the baseline condition, children (and adults) will be more likely to produce the preferred structure (adjective-noun phrase), showing that this is indeed the preferred structure, and that a noun-relative clause structure is less used by children in normal speech, when not primed.

## 3.3 Results

I shall divide the presentation of the results by participant group: first I will give the results from the experiment with children then I will provide the results from the adult participants including their responses to the questionnaire. Finally I shall present the analyses of the data.

### 3.3.1 Children's Results

In total, the children produced 429 responses of which 142 were to Adj+N primes, 143 were to N+RC primes and 144 were to baseline primes, (see Table 2 for a breakdown of the results). They produced 303 Adj+N responses (70.6%), 63 N+RC responses (14.7%) and 63 responses (14.7%) classed as 'Other'. This high proportion of 'other' responses will be examined separately; these responses were excluded from the statistical analyses.

Prime Condition	Responses			Total
	Adj-N	N-RC	Other	
<b>Adjective+Noun</b>	127	5	10	142
<b>Noun+Relative Clause</b>	77	50	16	143
<b>Baseline</b>	99	8	37	144
<b>Total</b>	303	63	63	429

Table 2: Children's Results

Figure 2 displays the distribution of responses as proportions of the total number of responses produced in each priming condition.

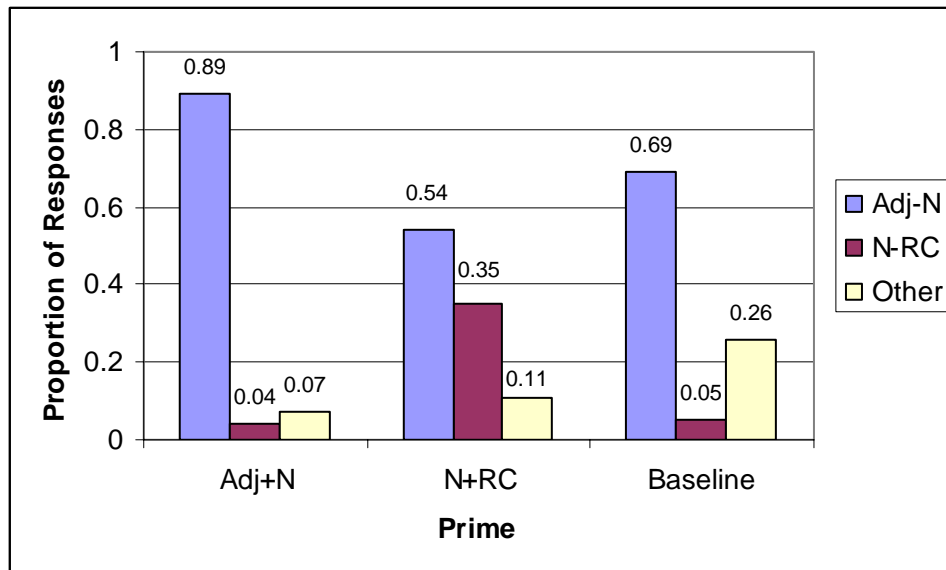


Figure 2: Proportion of children's responses to each prime.

Figure 2 shows that whilst the children produced very few noun-relative clause responses in the adjective-noun and baseline priming conditions, following a noun-relative clause prime more than a third of their responses used a noun-relative clause structure. Otherwise, the adjective-noun phrase was used most frequently in all conditions and was used following more than two-thirds of the baseline primes, that is, when neither structure was primed. As noted above, there was a large proportion of 'other' responses, and, as Figure 2 shows, many of these occurred in the baseline condition, a point I shall now look into in further detail.

### 3.3.2 Other Results

The child participants produced a large proportion of 'other' responses compared to the adult participants (see below) and to previous research. These responses therefore require further examination. Overall the children produced 63 'other' responses, almost 15% of their total responses. Table 3 shows what proportion of the 'other' responses occurred in each priming condition.

Prime Condition	'Other' Responses
Adjective-Noun	0.16
Noun-Relative Clause	0.25
Baseline	0.59

Table 3: Proportion of 'Other' Responses in each priming condition.

As can be seen, slightly more 'other' responses were produced in the noun-relative clause priming condition compared to the adjective-noun condition, however almost two-thirds of the 'other' responses were produced following a baseline prime. What was noticeable during



the transcription of the recordings was that the children often produced just a noun following the baseline prime (note that this prime consisted of only a bare noun). Therefore the number of ‘other’ responses that were just a noun were computed as proportions of the total number of ‘other’ responses, as were the other remaining responses, as represented in Table 4.

<b>Prime Condition</b>	<b>Other Responses</b>	
	<b>Noun</b>	<b>Other</b>
<b>Adjective-Noun</b>	0.095	0.06
<b>Noun-Relative Clause</b>	0.095	0.16
<b>Baseline</b>	0.460	0.13

Table 4: Proportion of bare noun responses and ‘other’ responses.

Table 4 shows a striking pattern: of the ‘other’ responses, almost half were a bare noun produced following the baseline prime, while this response was produced comparatively little in the other prime conditions. I shall discuss this finding further in the following chapter.

### 3.3.3 *Adult’s Results*

The adult participants produced 358 responses of which 119 were to Adj+N primes, 119 were to N+RC primes and 120 were to baseline primes. Overall they produced 336 Adj+N responses (94%), 12 N+RC responses (3%) and 10 responses (3%) classed as ‘Other’ (see Table 5 for a breakdown of the results). The responses classed as ‘Other’ were excluded from the statistical analyses. The results for the adult participants are represented in Figure 3 as proportions of the total responses in each condition.

<b>Prime Condition</b>	<b>Responses</b>			<b>Total</b>
	<b>Adj-N</b>	<b>N-RC</b>	<b>Other</b>	
<b>Adjective+Noun</b>	114	3	2	119
<b>Noun+Relative Clause</b>	109	8	2	119
<b>Baseline</b>	113	1	6	120
<b>Total</b>	336	12	10	358

Table 5: Adults’ Results

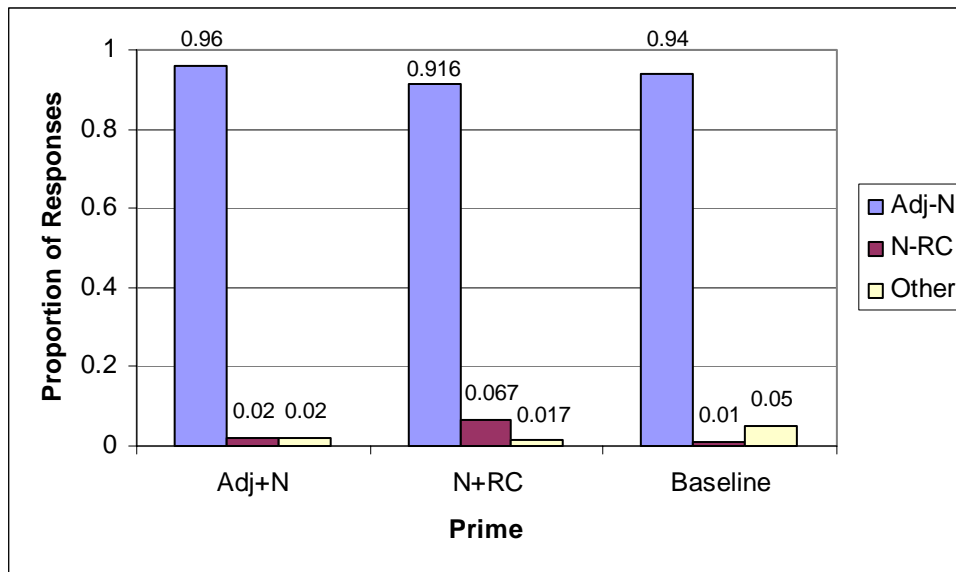


Figure 3: Proportion of adults' responses to each prime.

Figure 3 shows that the adults produced mostly adjective-noun responses in all prime conditions. There was a minor rise in the number of relative clause responses following a relative clause prime compared to the other priming conditions: this will be addressed in the analysis.

### 3.3.4 Questionnaire Responses

The adults' responses to the questionnaire (Appendix 7.2) that they completed following the priming task were as follows: 5/15 respondents thought the experiment was about children's reaction speeds identifying objects (question two), 7/15 thought it tested how they described objects: the words they used and, or, the word order, two participants wondered if it was to do with colour and object association, whilst only three participants guessed it might be about responding to what the experimenter said. The responses to question three were almost unanimous: 10/15 adults said they were aware that they used a 'colour-object' phrase (adjective-noun) to describe their own cards, some of these were aware that that was the only phrase they used; only two were aware that they had also used a 'object that's colour' (noun-relative clause) phrase out of the four adults that did use this construction. In response to question four most adults commented on the experimenter's black and white cards (the baseline cards): either that the experimenter did not describe them as 'white' or that only the experimenter had these cards (8/15 respondents) and a number of the adults (6/15) were also aware that the experimenter had used different phrases, namely the noun-relative clause structure, throughout the experiment.

These responses suggest that the adult participants were highly aware of the language they used and the fact that the experimenter's descriptions were different. However very few guessed that the changes in descriptions might be significant, that is, specifically done to affect the participant's responses. Although many deduced that the experiment might be testing children's descriptions, this is not surprising given the task was explicitly to describe the pictures they saw. None of the respondents stated that they *consciously* used a particular structure, or that they *consciously* swapped to another structure.

### 3.4 Analysis

For the analysis of the results the noun-relative clause responses were computed as proportions of the sum of adjective noun and noun-relative clause responses produced in each priming condition: this was done to allow for the uneven number of participants in each group and responses in each condition. Proportions were calculated for each participant and each item. Table 6 presents the means (see also Figure 4). The analyses were conducted with just the relative clause responses as proportions of the relative clause and adjective-noun responses, because, since these proportions are computed from just these two types of response, (and do not include the 'other' responses), the proportion of relative clause responses is also indicative of the proportion of adjective-noun responses. It can be surmised that a result found with the proportion of one reflects conversely the result of the other responses.

Prime Condition	Mean Proportion of Noun-Relative Clause Responses			
	Children		Adults	
	Participants	Items	Participants	Items
<b>Adjective-Noun</b>	0.04	0.037	0.027	0.02500
<b>Noun-Relative Clause</b>	0.40	0.390	0.067	0.06875
<b>Baseline</b>	0.09	0.075	0.000	0.00830

Table 6: Mean proportion of noun-relative clause responses by children and adults.

Table 6 shows that the mean proportion of noun-relative clause responses produced following the noun-relative clause prime compared to those produced in the other priming conditions showed a greater increase amongst the children, although there was a slight increase in the mean proportion of noun-relative clause responses produced by the adults following this prime. There were similar proportions of relative clause responses produced by the children and adults in the other priming conditions, although the children did generally produce more of this structure than the adults.

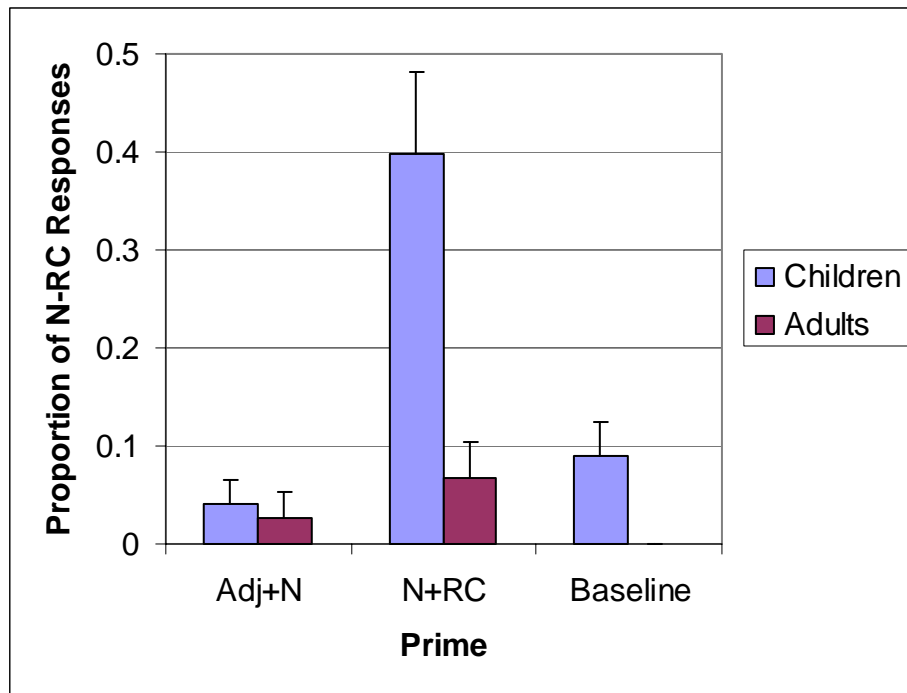


Figure 4: Mean proportion of children's and adults' noun-relative clause responses to each prime.

Two-way ANOVAs treating participants (F1) and items (F2) as random effects were conducted with the factors Prime (Adj+N, N+RC and baseline) and Group (children and adults). 'Prime' was a within-participants and within-items factor and Group a between-participants and within-items factor. The dependent variable was the proportion of relative clause responses produced in each priming condition. The analyses showed that there was indeed a significant effect of Prime, ( $F_{1[2,62]} = 16.190, p < .01, F_{2[2,46]} = 54.307, p < .01$ ), a significant effect of Group, ( $F_{2[1,23]} = 42.580, p < .01$ ), and a significant interaction between Prime and Group ( $F_{1[2,62]} = 8.849, p < .01, F_{2[2,46]} = 19.225, p < .01$ ), that is, the prime condition did effect the proportions of responses, there were differences between the two groups of participants, and the effect of prime was different in each group, as Figure 4 above suggests. In order to investigate this further, additional analyses were carried out on the children's and adults' results separately.

For the children, a one-way repeated-measures ANOVA (treating participants (F1) and items (F2) as random effects) with the factor Prime (within-participants, within-items) showed that there was a significant effect of prime on the proportion of relative clause responses produced by the children ( $F_{1[2,34]} = 17.692, p < .01, F_{2[2,46]} = 44.702, p < .01$ ). As it was predicted that the children would only produce more noun-relative clause responses following the noun-relative clause prime, and that following the baseline prime more adjective-noun responses would be produced, planned comparisons were carried out. These showed that the mean

proportion of relative clause responses in the relative-clause prime condition was significantly higher than the mean in the baseline condition ( $t_{1[17]} = 4.323$ ,  $p < .01$ ,  $t_{2[23]} = 6.666$ ,  $p < .01$ ) and the difference between the mean proportion of relative clause responses to the adjective-noun prime and to the baseline prime was not significant ( $t_{1[17]} = -1.609$ ,  $p = .126$ ,  $t_{2[23]} = -1.243$ ,  $p = .227$ ). This shows that only the relative-clause prime had a significant effect on the number of relative clause responses. These results will be discussed in the following chapter.

The same analyses were performed with the results from the experiments with adults. ANOVAs showed that the effect of prime on the proportions of relative clause responses only approached significance in just the items-wise analysis ( $F_{1[2,28]} < 1.8$ ,  $F_{2[2,46]} = 2.973$ ,  $p = .061$ ). Planned comparisons showed that the difference between the mean number of relative clause responses to the relative-clause prime and to the baseline prime was marginally significant ( $t_{1[14]} = 1.850$ ,  $p = .086$ ,  $t_{2[23]} = 2.383$ ,  $p < .05$ ). The difference between the mean number of relative clause responses to the adjective-noun prime and to the baseline prime was not significant ( $t_{1[14]} = 1.00$ ,  $p = .334$ ,  $t_{2[23]} = 1.00$ ,  $p = .328$ ).

Altogether these results show strong evidence for syntactic priming with children but not so with adults. These results will be discussed in more detail in the following chapter.

## 4 Discussion

In this chapter I shall discuss the results from the analysis. To begin with I shall discuss the effects found in the children's results, including the large proportion of 'other' results, then I shall examine the adults' results.

### 4.1 Children's Results

The analyses showed that the children were more likely to produce a noun-relative clause in the noun-relative clause prime condition than in the other conditions. Due to the experimental design it is possible to rule out certain other possible explanations for the data: because there were no repeated lexical items required in the prime and target pairs these results cannot be explained by children simply copying the phrase produced by the experimenter or by accessing item-based rules or representations. The explanation proposed here is that syntactic priming occurred. To recap, priming should occur when a phrase structure's abstract syntactic representation is activated previously through comprehension or production of that structure and when it is possible to use that structure in a subsequent utterance. In this experiment the children sometimes heard pictures described with a noun-relative clause structure, sometimes with an adjective-noun structure: priming would be said to have taken place if they also alternated their own use of these structures in responses to these changes, that is, if they were more likely to use an adjective-noun phrase following the adjective-noun primes, but less likely to use it following the noun-relative clause phrase and vice versa with regards the relative clause phrase. We would therefore expect to see more relative clause responses following the same structure prime, but not following the alternative prime. The results confirm this explanation: there were significantly more relative clause responses in the relative clause prime condition only.

The difference between the mean proportion of relative clause responses in the adjective-noun and baseline prime conditions was not significant which means that the mean proportion of adjective-noun responses (that is, the converse of the noun-relative clause responses) was not significantly different in the adjective-noun prime condition compared to the baseline condition. This suggests that there was no priming effect for the adjective-noun phrase, though this is in fact probably due to the children performing at ceiling level in this condition (indeed, in the adjective-noun prime condition, 96% of the children's (adjective-noun and noun-relative clause) responses were an adjective-noun phrase compared to 93% in the baseline condition). Therefore it can be inferred that overall priming did occur with these participants. This data also provides therefore further evidence that children aged three and four have abstract syntactic representations for nouns and their combinatorial properties.

#### 4.1.1 *Preferred and Dispreferred Structures*

The results also suggest that the adjective-noun construction was the preferred: following the baseline prime 93% of the sum of adjective-noun and noun-relative clause responses were adjective-noun responses, (of the total responses produced in this condition, including the ‘other’ responses, almost 70% were adjective-noun responses). This clearly indicates that the adjective-noun was indeed the preferred structure: if there was no preferred structure then we would expect the probability of either structure being used to be at chance level, at 50%. If the noun-relative clause structure was in fact preferred, we would expect to see more relative clause responses following the baseline and a significant difference therefore between this condition and the adjective-noun condition: there was no significant difference in the mean proportion of relative clause responses in the baseline condition and the adjective-noun condition. The baseline condition shows that the relative clause structure was indeed the dispreferred structure and that the adjective-noun was preferred. This experiment therefore provides evidence that it is possible to prime children to use a dispreferred alternative to a preferred structure, one that they would not normally use.

#### 4.1.2 *Children’s Susceptibility to Priming*

Furthermore, the experiment appears to show a strong priming effect with children: of their responses to the adjective-noun and noun-relative clause primes, 61% used the same structure as the prime. This is in fact somewhat less than the effect found by Branigan et al. (2005) who reported that 80% of the utterances had the same structure as the prime, however their experiment contained repeated lexical items which they showed increased the priming effect. Without the repeated lexical items, they found that 52% more of the children’s utterances had the same structure as the prime than did not. Given there was no lexical repetition in the present study, this effect of 61% priming appears to be fairly robust. These initial results support previous experiments’ findings of a strong priming effect in children, however the present study also tested adults using the same methodology to investigate what level of priming could be induced in adults using the same task and to therefore ascertain whether children were more susceptible to the priming than adults. I shall return to this point with the discussion of the results from the adult participants, however before, I will discuss the results of the analysis of the ‘other’ responses.

#### 4.1.3 *‘Other’ Responses*

It was shown that the children produced more ‘other’ responses than the adults and that most of these occurred in the baseline priming condition. It also emerged that most of these responses consisted of just a noun. The question to ask therefore is: was this structural priming too? On the surface it appears so since the children were more likely to produce a

bare noun following the baseline prime than following the other primes, although overall they were more likely to produce an adjective-noun phrase than anything else in this prime condition. The children always had to describe a coloured picture following this prime therefore the message they should have created should have always contained a colour description: an adjective. If it were the case that these bare noun phrases were structurally primed, this would imply that the syntactic structure somehow overrode the semantic content of the message that should have been created. This would mean that whilst at a semantic level the children should have activated a message containing an object and a colour, the activation at the syntactic level from the prime phrase containing only a noun would seem to have inhibited this semantic content and prevented the full message being syntactically generated resulting in just a bare noun being produced<sup>4</sup>. If this was indeed what happened, that the syntactic priming affected the semantic content of the message being produced, then the finding would have implications for the flow of activation in the model of language production discussed earlier.

It is however also possible that this finding was in fact an artefact of the experimental design or certain individuals: whilst the adults were mostly aware that the black and white were only described with a bare noun, the children might not have noticed this connection and therefore perhaps considered just a noun was sometimes a sufficient description for the pictures, given the experimenter was doing this. Some children who produced just a noun were simply quite resistant to being prompted for the colour of the object and then for a full description and did not react to this correction when they encountered further bare noun primes, whereas others who produced just a noun to describe their card and were subsequently prompted did not make the same mistake again following successive baseline primes. There could therefore be an effect of a few individuals.

In order to verify whether these findings were due to structural priming or caused by experiment artefacts it would be worth conducting a further experiment in the same manner as the present, this time including black and white pictures in the children's set to see whether they could be primed to use different descriptions for these cards themselves. That is, whether these cards were described with just a noun following the bare noun prime and a black and white card in the experimenter's set and whether they were described as '*white*' (such as '*a white bag*') following a coloured card in the experimenter's set and a suitable prime such as the adjective-noun prime. There would also have to be trials as in the present study where a bare noun prime and black and white card on the experimenter's turn was

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<sup>4</sup> Thanks to Dr. Branigan for the communication of these ideas.



followed by a coloured card in the participant's set to see whether they still produced bare nouns when a full noun phrase was required. The bare noun responses produced throughout the course of the experiment would be analysed to find out in which conditions they occurred.

Finally, it is worth noting that there were the same proportion of 'noun' responses in the adjective-noun and relative clause priming conditions, however, following the latter prime there were slightly more 'other' responses. Very often it was in fact difficult to tell from the audio recordings whether the children were actually producing a relative clause phrase such as '*a bag that's blue*' or whether they were saying '*a bag it's blue*'. Therefore in those cases where it was not clear caution prevailed and the response was classed as 'other'. This may explain why there were more 'other' responses following the noun-relative clause prime.

## 4.2 Adults' Results

With the adult participants, the results were not as conclusive as with the children. The effect of Prime only *approached* significance in the items analysis, and the planned comparisons also only showed a significant difference between the mean proportion of relative clause responses following a relative clause prime compared to the baseline prime in the items analysis. Otherwise the results from the experiments with adults were not significant. Interestingly, Cleland & Pickering (2003) reported that in their second experiment the priming effect for prime and target pairs where the nouns were not repeated was, at 8%, not statistically significant either. They did obtain significant priming effects when the prime and target contained the same or semantically related nouns, suggesting that there was a strong semantic effect on priming adults. This was not tested in the present study, therefore it would be interesting to repeat the present study using the child-orientated task (since Cleland & Pickering used a different experiment task) and including a repeated-noun priming condition to investigate whether priming could be induced with adults using the same method as used with children and therefore compare the magnitude of priming in each group.

### 4.2.1 Preferred and Dispreferred Structures

As with the children, the adjective-noun structure was clearly the preferred phrase for the adults: following the baseline prime 99% of the adjective-noun and noun-relative clause responses were adjective-noun (of the total responses produced in this condition, including the 'other' responses, 94% were adjective-noun responses). This phrase was in fact used for 94% of their responses across *all* the prime conditions.

#### 4.2.2 *Adults' and Children's Susceptibility to Priming*

Given that the results did not provide statistically significant evidence of priming with the adult participants it is unfortunately impossible to make any firm conclusions on the susceptibility of children to priming compared to adults. However, there was a strong priming effect with children and whilst it cannot be claimed that priming occurred reliably with adults, it cannot be ruled out as impossible with this method given the results from the items analysis. Perhaps with a greater number of adult participants it might be possible to obtain statistically significant results for an, albeit weak, priming effect with adults. With such a result it would be possible to rule out definitively the possibility that the strong effect in children was caused by the method used.

The results obtained with adults in the present study may also show artefacts of the method. Previous syntactic priming research with adults has included many more filler items than this research, and often the priming experiment was masked by a distracter task, therefore it is possible that this method was too obvious for adults and so affected the results. This is confirmed by the questionnaire responses which revealed that most adults were aware of how they described their pictures and that the experimenter varied her descriptions (although they were not aware of why this was done). Also, it seems that in this particular experiment the presence of black and white cards in the experimenter's set only did draw some participants' attention to the changes in description that were made by the experimenter and may therefore have drawn their attention to their own behaviour. In order to be able to directly test children's susceptibility to priming compared with adults, it is vital that the same method is used to test both groups: a different design might therefore be necessary to induce priming in adults as well as children, one that was not too obvious to adults but still simple enough to enable children to take part.

An alternative explanation is that it was not the methodology that was problematic, but the language tested using this method. The difference between saying '*a blue bag*' and '*a bag that's blue*' is, especially for adults, quite marked, as evidenced by the number of people who noted this switch in my descriptions, and the comparatively few adults who spontaneously used the latter phrase. It is generally less natural to use the relative clause structure to describe simple pictures unless the context requires a contrast to be marked, which this experiment did not. In order to further validate the present methodology it would be worth carrying out another priming experiment with children and adults playing a game of 'Snap' but priming different structures, for example using active and passive transitive sentences to describe different action pictures. If the difference between the alternative primes was less marked, it is possible that a more reliable priming effect would be obtained with adults using

the same method as above. Whilst the same predictions for the differing magnitude of priming in the different groups would be made, it might be possible to induce priming in more participants using phrases that were less obviously different. Therefore by changing the language used it might be possible to conduct an experiment where both child and adult priming can be reliably compared.

## 5 Conclusion

The findings from the present study support previous research in a number of areas: syntactic priming was induced from comprehension to production supporting the theory that priming is related to residual activation of syntactic representations accessed during both comprehension and production rather than the process of production itself. As in previous research, a strong priming effect was found with the children: a large proportion of their responses used the same structure as the priming utterance that preceded them. As found in previous research with these noun phrases, the adjective-noun phrase was shown to be the preferred construction, however due to the apparent strength of the priming effect, the mean proportion of noun-relative clause responses was raised significantly in the noun-relative clause prime condition.

Unfortunately, in the experiments with the adults the results did not provide a significant effect of prime: most of the responses in all priming conditions were adjective-noun phrases. The mean proportion of noun-relative clause responses was not raised enough following the same structure prime to suggest even a weak priming effect. The possibility that these results were due to the method used was considered in the previous chapter and ideas were presented as to how this method could be refined to obtain a priming effect with adult participants as has been achieved in previous experiments.

Without a reliable result from the adult participants it is not possible presently to make comparisons between the magnitude of priming in children and adults and therefore make any conclusions as to children's apparently high susceptibility to priming. However, consistent with previous experiments with children, the priming effect was stronger than that found in different experiments with adults. If we assume therefore that it might be possible to prime adults with this method and therefore that the strong effect found with children is not related to the method used, then a further question that will have to be addressed is, why should children be more susceptible to priming than adults?

There remains therefore a wide scope for future research in this area with both children and adults, with the structures tested here and with other areas of language. Adjustments to the method may need to be made in order to carry out a study in which children and adults are primed from exactly the same task and the magnitude of priming can be reliably compared.

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## 7 Appendices

### 7.1 Items

Experiment Items			
Number	Prime Condition	Prime	Target
1	Adjective-Noun	A yellow hen.	blue bag
	Noun-Relative Clause	A hen that's yellow.	blue bag
	Baseline	A hen	blue bag
2	Adjective-Noun	A blue snake.	pink bed
	Noun-Relative Clause	A snake that's blue.	pink bed
	Baseline	A snake	pink bed
3	Adjective-Noun	A pink cup	yellow boy
	Noun-Relative Clause	A cup that's pink.	yellow boy
	Baseline	A cup	yellow boy
4	Adjective-Noun	A pink leaf.	green cake
	Noun-Relative Clause	A leaf that's pink.	green cake
	Baseline	A leaf	green cake
5	Adjective-Noun	A blue square.	pink cat
	Noun-Relative Clause	A square that's blue.	pink cat
	Baseline	A square	pink cat
6	Adjective-Noun	A blue fork.	yellow chair
	Noun-Relative Clause	A fork that's blue.	yellow chair
	Baseline	A fork	yellow chair
7	Adjective-Noun	A green log.	blue drum
	Noun-Relative Clause	A log that's green.	blue drum
	Baseline	A log	blue drum
8	Adjective-Noun	A yellow moon.	green duck
	Noun-Relative Clause	A moon that's yellow.	green duck
	Baseline	A moon	green duck
9	Adjective-Noun	A green iron.	yellow flower
	Noun-Relative Clause	An iron that's green.	yellow flower
	Baseline	A iron	yellow flower
10	Adjective-Noun	A yellow bean.	blue frog
	Noun-Relative Clause	A bean that's yellow.	blue frog
	Baseline	A bean	blue frog
11	Adjective-Noun	A blue swan.	pink house
	Noun-Relative Clause	A swan that's blue.	pink house
	Baseline	A swan	pink house
12	Adjective-Noun	A green shed.	yellow jug
	Noun-Relative Clause	A shed that's green.	yellow jug
	Baseline	A shed	yellow jug
13	Adjective-Noun	A yellow hat.	blue lion
	Noun-Relative Clause	A hat that's yellow.	blue lion
	Baseline	A hat	blue lion
14	Adjective-Noun	A pink goal.	green pear
	Noun-Relative Clause	A goal that's pink.	green pear
	Baseline	A goal	green pear
15	Adjective-Noun	A blue sink.	pink pen
	Noun-Relative Clause	A sink that's blue.	pink pen
	Baseline	A sink	pink pen



16	Adjective-Noun	A yellow tent.	green bowl
	Noun-Relative Clause	A tent that's yellow.	green bowl
	Baseline	A tent	green bowl
17	Adjective-Noun	A pink stair.	blue queen
	Noun-Relative Clause	A stair that's pink.	blue queen
	Baseline	A stair	blue queen
18	Adjective-Noun	A pink slide.	green rocket
	Noun-Relative Clause	A slide that's pink.	green rocket
	Baseline	A slide	green rocket
19	Adjective-Noun	A green fish.	pink sock
	Noun-Relative Clause	A fish that's green.	pink sock
	Baseline	A fish	pink sock
20	Adjective-Noun	A green piano.	yellow spoon
	Noun-Relative Clause	A piano that's green.	yellow spoon
	Baseline	A piano	yellow spoon
21	Adjective-Noun	A yellow pocket.	blue star
	Noun-Relative Clause	A pocket that's yellow.	blue star
	Baseline	A pocket	blue star
22	Adjective-Noun	A pink flag.	green swing
	Noun-Relative Clause	A flag that's pink.	green swing
	Baseline	A flag	green swing
23	Adjective-Noun	A green shoe.	pink tap
	Noun-Relative Clause	A shoe that's green.	pink tap
	Baseline	A shoe	pink tap
24	Adjective-Noun	A blue toy.	yellow tree
	Noun-Relative Clause	A toy that's blue.	yellow tree
	Baseline	A toy	yellow tree

#### Filler Items

Number	Prime Condition	Prime	Target
1	Filler	A blue balloon.	blue balloon
2	Filler	A pink bike.	pink bike
3	Filler	A yellow bottle.	yellow bottle
4	Filler	A blue clown.	blue clown
5	Filler	A pink cow.	pink cow
6	Filler	A yellow hammer.	yellow hammer
7	Filler	A green elephant.	green elephant
8	Filler	Blue scissors.	blue scissors

#### Practice Items

Number	Prime Condition	Prime	Target
1	Practice	A pink pram	pink banana
2	Practice	A pink egg	yellow egg
3	Practice	A mouse	blue pig
4	Practice	An aeroplane	green teddy
5	Practice	A green rabbit	green rabbit

## 7.2 Questionnaire

### Experiment Questionnaire:

Thank you for taking part in my experiment. Before you leave, I'd be very grateful if you would take the time to fill in this brief questionnaire.

As explained at the beginning, the experiment today was a replication of an experiment I carried out with young children: I am currently collecting data from adult participants in order to have a control set against which to measure the children's behaviour. The task today may have seemed rather simple (!) because it was designed in order to maximise the children's co-operation and participation. I would therefore like to know your impressions of the experiment and a little of your background, this information will be treated confidentially.

Gender: ..... Age: .....

Occupation: .....

Area/subject of study (if student) : .....

Do you speak any other languages and at what level? .....  
.....

1. Please would you describe what you did in the experiment?

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.....  
.....  
.....  
.....  
.....  
.....

2. What do you think this experiment was about?

.....

.....

.....

.....

.....

3. While you were playing snap did you use any particular phrases to describe your cards?

.....

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.....

.....

.....

4. Were you aware of what your 'opponent' said to describe their cards?

.....

.....

.....

.....

.....

5. Do you have any other comments about this study or today's experiment?

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**Thank you very much once again for your time and co-operation!**

